

**IN THE CLAIMS:**

- 1 1. (CURRENTLY AMENDED) A method for integrating traffic shaping and link sharing  
2 functions to enable scaling of a plurality of queues multiplexed to media links of an in-  
3 termediate station in a computer network, the queues storing data packets that are des-  
4 tined for the media links, the method comprising the steps of:  
5       assigning committed information bit rate (CIR) and excess information bit rate  
6 (EIR) bandwidth values per queue, along with a shaped maximum bit rate per media link;  
7       uniformly scaling the EIR bandwidths of all queues sharing a media link so that  
8 the sum of all scaled EIR bandwidths equals an available bandwidth of the shaped media  
9 link;  
10       calculating when a queue is next eligible for servicing; and  
11       storing event notifications in a timing wheel, each event notification having a  
12 hash entryies identifying a queue, a media link, and a priority, the event notifications ~~are~~  
13 triggered when a queue is eligible for servicing.
- 1 2. (ORIGINAL) The method of Claim 1 wherein the step of storing comprises the step of  
2 providing a timing wheel having a plurality of fields per time slot, wherein the fields rep-  
3 resent different service priorities of queues.
- 1 3. (PREVIOUSLY PRESENTED) The method of Claim 2 wherein the step of providing  
2 a timing wheel comprises the step of configuring pointers to the queues to thereby obvi-  
3 ate overhead incurred when searching the timing wheel for other references to the pack-  
4 ets.
- 1 4. (ORIGINAL) The method of Claim 3 wherein the step of providing a timing wheel  
2 further comprises organizing the timing wheel as a contiguous array of time slots contain-  
3 ing pointers to linked lists.

1 5. (ORIGINAL) The method of Claim 4 wherein the contiguous array is a hash array and  
2 wherein the linked lists are hash lists.

1 6. (ORIGINAL) The method of Claim 3 wherein the step of providing a timing wheel  
2 further comprises organizing the timing wheel as a descriptor ring having a plurality of  
3 per-time-slot queues.

1 7. (CURRENTLY AMENDED) A system for integrating traffic shaping and link sharing  
2 functions to enable scaling of a plurality of queues multiplexed to media links of an in-  
3 termediate station in a computer network, the queues storing data packets that are des-  
4 tined for the media links, the system comprising:

5 queuing logic configured to organize the queues into class queues of a plurality of  
6 queue sets, each queue set coupled to inputs of a sublink multiplexer having an output  
7 coupled to a media link via a media link queue; ~~and~~

8 a queue scheduler configured to assign each class queue committed information  
9 bit rate (CIR) and excess information bit rate (EIR) bandwidths, and the media link a  
10 shaped maximum bit rate; and

11 the queue scheduler further including a timing wheel organized as a descriptor  
12 ring with time slots, wherein each time slot includes a queue-depth index that references  
13 a tail of a list of queue descriptors associated with that time slot, each queue descriptor of  
14 the list of queue descriptors to indicate that a particular class queue is eligible for servic-  
15 ing.

1 8. (ORIGINAL) The system of Claim 7 wherein the queue scheduler comprises a EIR  
2 scaler that uniformly scales the EIR bandwidths of all queues sharing a media link so that  
3 the sum of all scaled EIR bandwidths equals an available bandwidth of the shaped media  
4 link.

1 9. (ORIGINAL) The system of Claim 8 wherein the queue scheduler further comprises a  
2 virtual time policer (VTP) configured to determine whether the media links are compliant  
3 and to calculate when a queue is next eligible for servicing.

1 10. (CANCELLED)

1 11. (CANCELLED)

1 12. (CURRENTLY AMENDED) The system of Claim-~~11~~ 7 wherein the queue descrip-  
2 tors include a queue index that references a class queue of the queuing logic.

1 13. (CURRENTLY AMENDED) The system of Claim-~~12~~ 7 wherein the queue descrip-  
2 tors include a media link interface that references a media link coupled to the intermedi-  
3 ate station.

1 14. (CURRENTLY AMENDED) The system of Claim-~~12~~ 7 wherein the queue descrip-  
2 tors include a priority value indicating a priority level assigned to a queue.

1 15. (CANCELLED)

1 16. (CANCELLED)

1 17. (CURRENTLY AMENDED) A method for integrating traffic shaping and link shar-  
2 ing functions to enable scaling of a plurality of queues multiplexed to media links of an  
3 intermediate station in a computer network, the queues storing data packets that are des-  
4 tined for the media links, the method comprising the steps of:

5 notifying a queue scheduler when each packet is forwarded to a queue;  
6 determining if the queue is ~~inactive for~~ using a committed information bit rate  
7 (CIR) and ~~for~~ if the queue is using an excess information bit rate (EIR);

8 if the queue is ~~inactive for not using~~ the CIR, ~~activating making use of~~ the CIR  
9 and ~~incrementing including such use in an~~ calculated aggregate CIR bandwidth for a me-  
10 dia link;

11 if the queue is ~~not inactive for using~~ the CIR, ~~activating making use of~~ the EIR  
12 ~~rate and including such use in incrementing a calculated~~ the aggregate EIR bandwidth for  
13 the media link; and

14 calculating an EIR scale factor of the media link.

1 18. (PREVIOUSLY PRESENTED) The method of Claim 17 further comprising the  
2 steps of:

3 retrieving a queue descriptor from a timing wheel, wherein the queue descriptor  
4 includes a queue index, a media link interface , and a priority value;

5 comparing a calculated link VTP timestamp of a media link queue with a current  
6 real time and burst value to ensure that collisions between an eligible queue and other  
7 queues do not cause the media link queue to exceed a configurable limit;

8 if the media link queue does not exceed the configurable limit, issuing a dequeue  
9 command to the queuing logic for the eligible queue;

10 in response to the command, dequeuing a packet from the eligible queue;

11 returning a length of the dequeued packet as dequeue status to the queue sched-  
12 uler; and

13 if the queue length is non-zero, sending the dequeued packet to a media controller  
14 for loading into the media link queue.

1 19. (ORIGINAL) The method of Claim 18 further comprising the steps of:

2 periodically sending depth threshold status of the media link queue to the queue  
3 scheduler;

4 if the depth threshold status indicates that there are more bits in the media link  
5 queue than the link VTP timestamp represents, incrementing the link VTP timestamp;

6 correlating the dequeue status with the issued dequeue command;

7           if a dequeued byte count is non-zero, marking the queue as eligible for servicing;  
8           if the dequeued byte count is zero, deactivating one of the CIR and EIR of the  
9 queue; and  
10          decrementing one of the CIR and EIR aggregate bandwidths of the link.

1   20. (CANCELLED)

1   21. (CURRENTLY AMENDED) A method for operating an intermediate station, comprising:  
2

3           dividing the intermediate station into a plurality of queues multiplexed to a plurality of media links, the queues storing data packets that are destined for the media links;

5           storing event notifications in lists associated with a plurality of time slots within a timing wheel to indicate when a queue is eligible for servicing, ~~where each event notification~~  
6 ~~time slot in the plurality of time slots including~~ es a hashed entry, the hashed entry  
7 identifying a queue index (Q), a media link interface (I), and a priority value (P) for each  
8 queue; and  
9

10          upon a ~~time ing~~ slot in the plurality of time slots becoming a current time slot,  
11 checking each ~~entry event notification in a the~~ list associated with the time slot, to determine which packets to send.  
12

1   22. (CURRENTLY AMENDED) The method of Claim 21 further comprising:

2           storing ~~similar entries event notifications~~ for the same queue at a first time slot  
3 and a second time slot, where the second time slot is further in the future than the first  
4 time slot, ~~and the event notification an entry at the second time indicates is a higher priority~~  
5 then the event notification an entry at the first time slot.

1   23. (CANCELLED)

1 24. (NEW) A system for integrating traffic shaping and link sharing in a network de-  
2 vice, the system comprising:

3 queuing logic configured organize a plurality of class queues into a plurality of  
4 queue sets, each class queue associated with a particular type of data and, each queue set  
5 coupled to a particular media link of a plurality of media links; and

6 a queue scheduler configured to assign each class queue a committed information  
7 bit rate (CIR) and a excess information bit rate (EIR) bandwidth, the EIR bandwidth  
8 scaled so that the sum of all scaled EIR bandwidths of all the class queues of a queue set  
9 does not exceed an available bandwidth of the shaped media link coupled to the queue  
10 set,

11 the queue scheduler further including a timing wheel organized as a descriptor  
12 ring with time slots, wherein each time slot includes a queue-depth index that references  
13 a tail of a list of queue descriptors associated with that time slot, each queue descriptor of  
14 the list of queue descriptors to indicate that a particular class queue is eligible for servic-  
15 ing.

1 25. (NEW) The system of Claim 24 wherein each queue descriptor comprises a queue  
2 index that specifies the class queue eligible for servicing.

1 26. (NEW) The system of Claim 24 wherein each queue descriptor comprises a media  
2 link interface that specifies the media link coupled to queue set that includes the class  
3 queue eligible for servicing.

1 27. (NEW) The system of Claim 24 wherein each queue descriptor comprises a priority  
2 value that specifies a priority level assigned to the class queue eligible for servicing.

1 28. (NEW) The system of Claim 24 further comprising:

2 a virtual time policer (VTP) configured to determine whether utilization of buffers  
3 associated with the media links exceed configurable limits and to calculate when each  
4 class queue is next eligible for servicing.

1 29. (NEW) A method for integrating traffic shaping and link sharing in a network de-  
2 vice, the method comprising:

3 organizing a plurality of class queues into a plurality of queue sets, each class  
4 queue associated with a particular type of data and, each queue set coupled to a particular  
5 media link of a plurality of media links;

6 assigning each class queue a committed information bit rate (CIR) and a excess  
7 information bit rate (EIR) bandwidth;

8 scaling each EIR bandwidth so that the sum of all scaled EIR bandwidths of all  
9 the class queues of a queue set does not exceed an available bandwidth of the shaped me-  
10 dia link coupled to the queue set; and

11 indicating when class queues are eligible for servicing with a timing wheel organ-  
12 ized as a descriptor ring with time slots, each time slot including a queue-depth index that  
13 references a tail of a list of queue descriptors associated with that time slot, each queue  
14 descriptor of the list of queue descriptors indicating that a particular class queue is eligi-  
15 ble for servicing.

1 30. (NEW) The method of Claim 29 wherein each queue descriptor indicates the class  
2 queue eligible for servicing.

1 31. (NEW) The method of Claim 29 wherein each queue descriptor indicates the media  
2 link coupled to queue set that includes the class queue eligible for servicing.

1 32. (NEW) The method of Claim 29 wherein each queue descriptor indicates a priority  
2 level assigned to the class queue eligible for servicing.

1 33. (NEW) The method of Claim 29 further comprising:  
2 determining whether utilization of buffers associated with the media links exceed  
3 configurable limits; and  
4 calculating when class queues are next eligible for servicing.

1 34. (NEW) A system for integrating traffic shaping and link sharing in a network de-  
2 vice, the system comprising:  
3 means for organizing a plurality of class queues into a plurality of queue sets,  
4 each class queue associated with a particular type of data and, each queue set coupled to a  
5 particular media link of a plurality of media links;  
6 means for assigning each class queue a committed information bit rate (CIR) and  
7 a excess information bit rate (EIR) bandwidth;  
8 means for scaling each EIR bandwidth so that the sum of all scaled EIR band-  
9 widths of all the class queues of a queue set does not exceed an available bandwidth of  
10 the shaped media link coupled to the queue set; and  
11 means for indicating when class queues are eligible for servicing with a timing  
12 wheel organized as a descriptor ring with time slots, each time slot including a queue-  
13 depth index that references a tail of a list of queue descriptors associated with that time  
14 slot, each queue descriptor of the list of queue descriptors indicating that a particular  
15 class queue is eligible for servicing.